2003

Strategic Planning, Impact Assessment, and Technical Aid: The Souss-Massa Integrated Water Management Project

John E. Keith
Utah State University

Said Ouattar

Economic Research Institute Study Paper

ERI #2003-10

STRATEGIC PLANNING, IMPACT ASSESSMENT, AND TECHNICAL AID: THE SOUSS-MASSA INTEGRATED WATER MANAGEMENT PROJECT

by

JOHN E. KEITH, PROFESSOR & CHIEF OF PARTY

SIWM Project, Agadir, Morocco
and
Department of Economics
Utah State University
3530 Old Main Hill
Logan, UT 84322-3530

SAID OUATTAR, PROFESSOR & DEPUTY CHIEF OF PARTY

SIWM Project, Agadir, Morocco
and
Department of Agronomy
IAV Hassan II University
Rabat, Morocco

August 2003

STRATEGIC PLANNING, IMPACT ASSESSMENT, AND TECHNICAL AID: THE SOUSS-MASSA INTEGRATED WATER MANAGEMENT PROJECT

John Keith, Professor

Department of Economics
Utah State University
3530 Old Main Hill
Logan, UT 84322-3530

Said Ouattar, Professor

Department of Agronomy
IAV Hassan II University
Rabat, Morocco

STRATEGIC PLANNING, IMPACT ASSESSMENT, AND TECHNICAL AID: THE SOUSS-MASSA INTEGRATED WATER MANAGEMENT PROJECT

John E. Keith and Said Ouattar

ABSTRACT

Integrated river-basin management requires several basic conditions. Among these are clear communications among all the actors involved in managing the basin's water resources, one or more sets of data which are shared by all decision-makers, and tools by which the decision-makers can evaluate policies (impact assessment). Developing integrated management in conjunction with the creation of River Basin Agencies is the objective of the USAID-sponsored Souss-Massa Integrated Water Management (SIWM) project. The project activities have been designed to develop and support communications, data sharing and model building within the institutions in the Souss-Massa Basin as a demonstration for all Moroccan river basins.

STRATEGIC PLANNING, IMPACT ASSESSMENT, AND TECHNICAL AID: THE SOUSS-MASSA INTEGRATED WATER MANAGEMENT PROJECT*

Introduction[1]

The Souss-Massa River Basin, which is bounded on the north by the High Atlas Mountains and on the south and east by the Anti-Atlas Mountains, covers approximately 27,000 square kilometers. With a year-round growing season, irrigated agriculture in the river basin produces more than half of Morocco's exported citrus and vegetables. Surface water is collected and stored behind seven dams that have a combined total capacity of approximately 1,608 million cubic meters. Groundwater is obtained primarily from the Souss Valley alluvial aquifer. The reported recharge rate is approximately 450 million cubic meters annually, an amount that varies significantly in response to rainfall.

The total water use in the Basin is approximately 965 million cubic meters per year. Overall, demand for water exceeds the sustainable supply, with the deficit being made up by mining groundwater. Over-pumping of the alluvial aquifer exceeds an average of 260 millions cubic meters per year, which has resulted in water level declines ranging from 0.5 to 2.5 meters per year during the past three decades. Approximately 94% of the water resources in the Souss-Massa Basin are used for irrigation as compared to approximately 85% to 90% for all of Morocco (Direction Générale Hydraulique du Maroc, 1999). The remaining 5% to 6% are used for public and industrial supply. The major areas of irrigation are restricted to the Massa and the Souss Valleys. Some of the most intensive irrigation is centered near the Guerdane area, approximately 50 km west of Agadir in the Taroudant area near the Souss River.

---

*The material for this paper was drawn from the Souss-Massa Integrated Water Management Project, managed by Development Alternatives Incorporated (DAI), Bethesda, Maryland, and funded by the United States Agency for International Development (USAID). The authors wish to thank both for their comments and support ; any errors are solely the authors' responsibility. Opinions expressed are those of the authors and do not necessarily represent the views of DAI or USAID.

[1]The discussion in the introduction is taken in large part from Kent and Ouattar, undated.

Water rights established before1914 were traditionally held by communities for irrigation and potable water. During the French colonial period, water ownership by the state was recognized, and intensive irrigation began. Following independence in 1952, the Government of Morocco continued to view irrigation development as crucial to the economy and encouraged new developments. Since 1960, the Souss-Massa basin has become the major Moroccan exporter of fruits (50%) and vegetables (45%), in an economy in which agriculture provides 18% of the GDP and 40% of the employment. The Souss-Massa is fortunate to have a climate which permits year-round production and growing seasons which offer good access to foreign markets. In addition, the Souss-Massa basin, and Agadir, in particular, has become an international tourist destination. Water use by large hotels and other recreational facilities, such as golf courses, is large and sure to increase. However, the responsibility for water management has been fragmented at best. A significant part of the problem of over-consumption is institutional and involves the lack of coordinated planning and policy among the various water managers and consumers. It is this planning and policy making on which this paper will focus.

The Institutional Context

Prior to the passage of the new water law in 1995 (Law 10-95), responsibility for various aspects of water management rested in several agencies. The primary decision-making occurred at the national levels. In general, important policy decisions were made in Rabat. The regional administrations essentially carried out national policy, with limited discretion.

The Direction Regionale Hydraulique (DRH), under the Ministry of Public Works (Ministre d'Equipement), essentially managed surface water supplies, planning and constructing dams, regulating releases and flows, managing flood control and providing water (wholesaling) to other agencies.

The Ministry of Agriculture, through the regional Offices Regionales de la Mise en Valeur de l'Agriculture (ORMVA), was provided surface flows from storage by the DRH, and in turn allocated water (with a minimal price) to the various associations and individual farmers. ORMVA's goal was to expand irrigation, modernize it, and assure

that agriculture would continue to provide an economic engine for Morocco, and for the Souss-Massa. ORMVA used new wells to augment its surface water supply as irrigated perimeters were created and intensive irrigation expanded.

The Offices Nationales d'Eau Potable (ONEP) furnished potable water, both in the rural areas and in larger cities, using the same water sources. In addition, the very large cities had quasi-private metropolitan water offices which received water from ONEP and provide it to end users (for example, the Regie Autonome Multi-Services, Agadir - RAMSA). As the cities expanded, both ONEP and RAMSA expanded their groundwater resources (as well as benefiting from new DRH storage facilities). Authorization for drilling wells and using groundwater emanated from ORMVA, and the DRH. Moreover, water quality issues, when even considered, were the responsibility of the potable water agency, but came under at least the monitoring auspices of the Ministry of Environment.

Thus, decisions regarding water use and development were primarily single-focus. DRH targeted the management of surface water resources and facilities, ORMVA looked toward expansion of irrigation, ONEP was occupied with the growth of urban and rural potable water needs, and so on. The lines of communications were mainly up and down the chain of command of each Ministry and agency, with little horizontal (inter-agency) exchange.

In addition, the planning and management of water resources in Morocco has been, for the most part, highly centralized. For example, water prices for irrigation were set in Rabat, and vary only slightly among the various river basins, irrespective of water scarcity. Management plans (Plans Directeur, such as found in Conseil Supérieur de l'Eau et du Climat, 2000; Ministère de l'Intérieur, undated) for all the regional agencies were (and are) developed at the central level, albeit with considerable cross-agency input at that level. Even now, few regional agencies seem inclined or perhaps even willing to discuss modifications of those Plans Directeur without national approval. There was little inter-agency communication regarding policy at the regional level, and probably not much more between the regional and national arms of a given agency.

For over 30 years, the Moroccan government (GOM) emphasized the need to develop Morocco's water resources. In 1967, a national goal was established to have one

million hectares of land under irrigation before the year 2000. In 1986, the government established a goal to build one dam per year. These goals were both consistent with Morocco's long term water management strategy of "Not one Drop to the Sea" (World Bank, 1995). Given that Morocco in general, and the Souss-Massa in particular, face limited and exhaustible ground water supplies in an area with highly variable surface water resources, the results of the emphasis on growth coupled with the institutional "tunnel vision" were predictable. Augmented surface water supplies could not keep up with demand, pumping increased and the water table fell rapidly in many places. Management prerogatives and politics ensured that the problems of regional integrated conjunctive use and water quality were not going to be solved by one agency acting alone.

Annual declines in the aquifer in the Guerdane area reflect the intensity of farming and pumping (Figure 1). By 2010, groundwater levels may be sufficiently deep to make pumping uneconomical in many locations.

It became clear that important changes had to occur. First, emphasis on water management for optimum benefits replaced the expansion of demand as a guiding principle (Conseil Supérieur de l'eau, 2000). Next, water managers had to have a broader perspective to plan for the maximum sustainable production from the renewable and non-renewable water resources. Finally, local water problems had to be met with local solutions and with flexibility. With these goals in mind, the new water law was passed in 1995.

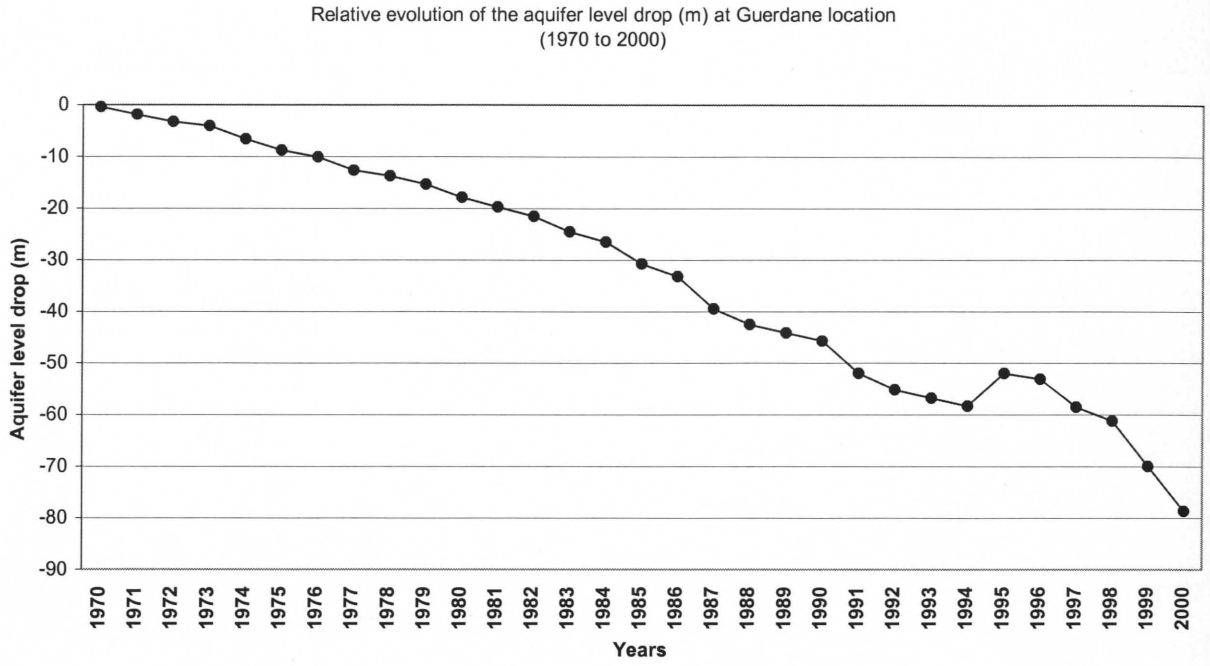

Figure 1. Aquifer levels at Guerdane region

The 1995 water law in Morocco (Law 10-95) has those two major targets in mind. The Law created Agences de bassin Hydraulique (AbH) [or River Basin Agencies - RBAs] which have a broad mandate for managing the water resources, both surface and ground. Within the new law, well authorizations, allocations of surface water, water quality monitoring and management, and several other aspects of water management were vested in the new AbHs. However, budgets for these agencies were based on the previous DRHs, and resources to manage the broader mandate are very limited. Even though these agencies are expected to be self-sustaining in the longer term, the short run water management problems are still a function of differing - and competing - demands and objectives. For that reason alone, regionalization of decision-making within and among the various agencies with roles to play in water management became an objective of the GOM.

The SIWM Project

After the passage of Law 10-95, the Government of Morocco enlisted the support of the U.S. Agency for International Development (USAID), among others, for the

development of RBA capacity for integrated water management. Since the Souss-Massa basin is both critical to the regional and national economy, and one of the most water-short regions in Morocco, it was chosen as the demonstration basin for the new RBAs.

The premise of the Souss-Massa Integrated Water Management (SIWM) project, funded by USAID and managed by Development Alternatives, Inc., of Bethesda, Md., is that a healthy, functioning Agency with a broad perspective is necessary for good water management. None-the-less, a functioning agency with an integrated approach (ground water, surface water, and water quality) is not a sufficient condition for good water management. The various regional "partners" in managing the local water resources must be involved with decision-making and planning. But simply having the various agencies communicate will not assure integrated management. Tools must be in place through which the various agencies can analyze alternative courses of action under various external constraints. Thus, SIWM's approach is to support the institutional development of the RBA, encourage inter-agency communications at many levels and provide a set of tools by which the partners can make appropriate local policy. The specific objectives of the SIWM project are:

- Strengthening the capacity of the RBA to implement Law 10-95
- Establish intra- and inter-institutional mechanisms for collaboration
- Establish sustainable financing mechanisms for the RBA
- Create effective and transparent communications systems for all stakeholders
- Provide management tools and focused training programs for stakeholder institutions
- Establish baselines and monitoring systems
- Ensure stakeholder participation in water management, and
- Help Morocco establish appropriate water policy

Beginning in 2000, the SIWM project identified several activities which appeared to be critical to developing regional integrated decision-making. The first activity (Component 1) was related to planning and support of the development of the RBA and a process of cooperative water management. The second activity (Component 2) involved implementing a set of "pilot projects" demonstrating "best practices" in water management, from which both water managers and water users could benefit. The third

activity (Component 3) involved including NGOs, such as water user associations and communes, in local water management. In 2002, a fourth activity was added to the SIWM project. In recognition of the importance of the coastal areas, both economically and environmentally, the first steps toward integration of coastal zone issues into the planning for the Souss-Massa river basin were begun.

SIWM's activities, then, are quite diverse. They involve institutional support for the Agencies and for strategic planning, but also include such pilot projects as the installation of telemetry capability in the three agencies charged with wholesale (gross) water distribution, installation of GIS stations and associated training for all the main partners, inventories of wells and of pollution point sources, dissemination of real-time irrigation requirements by crop, conversion of gravity to drip irrigation by water user associations, and the development of shared data bases and analytical tools. A program of small grants to local water user associations for improved irrigation and potable water systems has also been developed. Clearly, many of the specific activities contribute more than tangentially to consistent and integrated water management, and may have important impacts on the Souss-Massa resource base and economy, but space and time constraints require a more pointed discussion. The focus of this paper will be on specific activities and lessons learned that are more closely related to impact assessment and strategic planning.

SIWM and Integrated Planning

As indicated above, there is no lack of long term planning and plans in Morocco. However, it was clear in the Souss-Massa that coordination and planning at the regional (river basin) level was not common. Agencies and water users focused only on their portion of water-related activities. No one agency had an overall perspective. As would be predicted by models of the political economy, water was used inefficiently, both as an input and a waste sink. An initial analysis suggested that the partners needed to have ways to share not only their official plans, but their concerns and their understanding of the physical and economic system (Kent et al., 1999; Ouattar and Reiss, 2002). To that end, a Regional Committee was formed under the SIWM project, composed of the directors or other responsible representatives of regional entities with an interest in water

management. These members included, of course, the new RBA, ONEP, RAMSA, and ORMVA. However, other partners were also viewed as essential to integrated water management. These included representatives from the Ministry of Environment (Cellule environnement) and Office of Regional and Urban Planning (Inspection de l'Habitat), Health, Natural Resources (Eaux et Forets), and elected representatives from the Governor (Wilaya) and the Regional Council (Conseil Regional). The Regional Committee would serve as the oversight for the project and also have a role in the Board of Directors of the Agency, once it was firmly established and fully functional.

The new RBA was not established with a director and budget until April, 2002. Thus, little could be accomplished within Component 1. However, the cooperative planning efforts were begun with the formation of the first Interagency Technical Working Group (IATWG). This group was charged with identifying, selecting and designing the pilot projects ("real" or "concrete" activities as requested by the partners) which would be implemented by SIWM. The IATWG was composed of directors and representatives of the partners, including the Director of the existing DRH. A total of six pilot projects were identified, as described above. The process involved several months of meetings and discussions among the partners. Once these pilot projects were identified by the IATWG, specific technical working groups were formed, made up of those partners directly involved with the projects.

The first pilot project to be implemented was the development of easily accessible "harmonized" data bases. Each agency contributed to the data base, which was then compiled and distributed on electronic media and through a new website (http://www.eau.ma). The website also contains significant information regarding water use and conservation, water pricing, lists of NGOs involved in water management, and other topics. Transparent data sharing has been identified by many development workers as a fundamental key to good management of all resources. However, achieving data harmonization is seldom easy, since data are valuable commodities. Together with the IATWG, the TWG formed around this pilot project helped established lines of communication among the partners and the cooperative atmosphere on which SIWM could base its support. The website and data bases has been visited well over 5,000 times in the past 16 months, with the number of "hits" increasing at an average rate of over

25% per month. Moreover, the telemetry data, which will be collected by the telemetry pilot project facilities, will eventually be included in the databases accessible on the website.

With the establishment of the new RBA in April, 2002, a study tour was provided for the members of the Regional Committee (most of whom were also members of the IATWG). This study tour had three objectives. The first was to demonstrate integrated water management practices from the United States. The second was to introduce strategic planning and management processes as practiced in the U.S. The third, and probably most important, was to continue the inter-agency dialogue regarding water issues and management in an atmosphere removed from everyday duties and conflicts and with a focus on possible solutions to the problems faced in the Souss-Massa basin. Evaluations of this study tour suggest that, far from being a perquisite for agency leaders, it was highly successful in contributing to discussion and exchange among regional managers who didn't normally interact on water issues.

Following the study tour, activities in Component 1 began in earnest. Consultants were employed to examine the RBA and its organizational, financial, and training needs. Preliminary reports outlined possible organizational structure (with organization charts and manning documents), financial constraints and opportunities, and training needs in accounting, human resource management, and communications. That activity continues today, along with the development of an agency strategy and business, plan.

At the same time, efforts were begun to establish a strategic planning process at the regional level, involving all the regional partners. Within the strategic planning approach, several aspects of the legal and institutional situation were highlighted. First, conversation with regional leaders reconfirmed the original impression of planning: While strategic plans were developed with multiple agency input at the national level, once those plans were in place there was little productive exchange at the regional level among the partners. Second, the RBA by itself can not be expected to manage the water resources of the basin unless its efforts are supported and coordinated with the partners. Third, there is a lack of consideration of many of the available demand management tools in all the plans directeurs and studies for most, if not all, of the agencies.

The demand management proposed in these plans is based on technical improvements (such as drip irrigation). Water consumers do pay for at least some of their water in the Souss-Massa. ORMVA, ONEP and RAMSA all charge for water which they deliver to end consumers. The costs are low and represent operation and maintenance costs alone. The average urban charge (at current exchange rates) to households and hotels for water delivered by RAMSA in Agadir is U.S.$0.28/$m^3$ ($0.001/gallon) for users consuming less than 24 m^3 (6,350 gal)/month, $0.76/$m^3$ ($0.003/gal) from 25 to 60 m^3 (15,850 gal)/month, and $ 0.93/m^3 ($.0035/gal) for users consuming more than 60 m^3/month. Industrial users pay about $0.58/$m^3$. The average charge for (surface) irrigation water is approximately U.S.$0.05/$m^3$ ($62/acre foot). Because neither urban nor irrigation rates include the capital cost of construction of dams, urban charges frequently cover only 50% of the full cost of water and irrigation charges ranges from 10% to 40% of the full cost of water. Private well owners do not currently pay for water. There is an incentive to use groundwater for irrigation so long as pumping costs do not exceed the surface water costs. The 1995 water law, when fully implemented, will allow the Souss-Massa Basin agency to charge approximately U.S.$0.002/$m^3$ ($2.50/ acre foot) of groundwater pumped from private wells, but that price is not likely to impact the decision to pump for most water users.

SIWM and Impact Assessment

One of the goals of impact assessment is to examine the consequences of alternative actions. To take advantage of the shared data bases, facilities and training in Geographic Information Systems were provided to the partners by SIWM. GIS coupled with satellite imagery and interpretation, a part of the GIS training, has provided a basis for looking at long term trends in cropping patterns in the Souss-Massa basin (Bouvier, and Popescu, 2003). This analysis, completed as a part of partner training in GIS use, suggests that citrus production has grown about 35% (approximately 6,500 hectares [ha]) from 1984 to 2002, particularly in the zones east of Taroudant. It has also provided estimations of the dramatic increase in vegetable production under plastic, particularly in the Massa basin (from almost none to approximately 8,000 ha). (See Figures 2 and 3, and Table 1). These increases in irrigated agriculture are only in a small part offset by

reductions in the more traditional olive (about 300 ha) and field crop (about 800 ha) production.

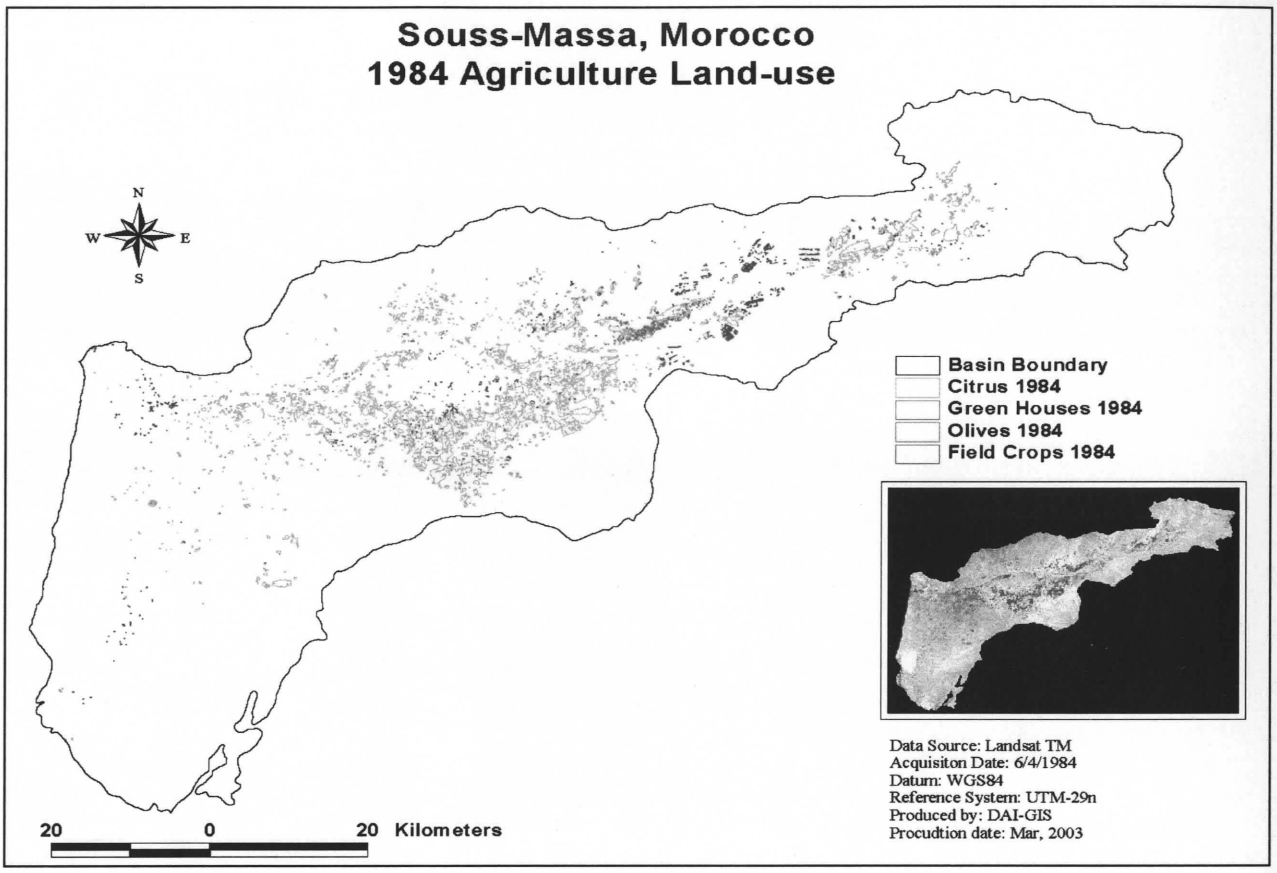

Figure 2. 1984 Cropping (Bouvier and Popescu, 2003)

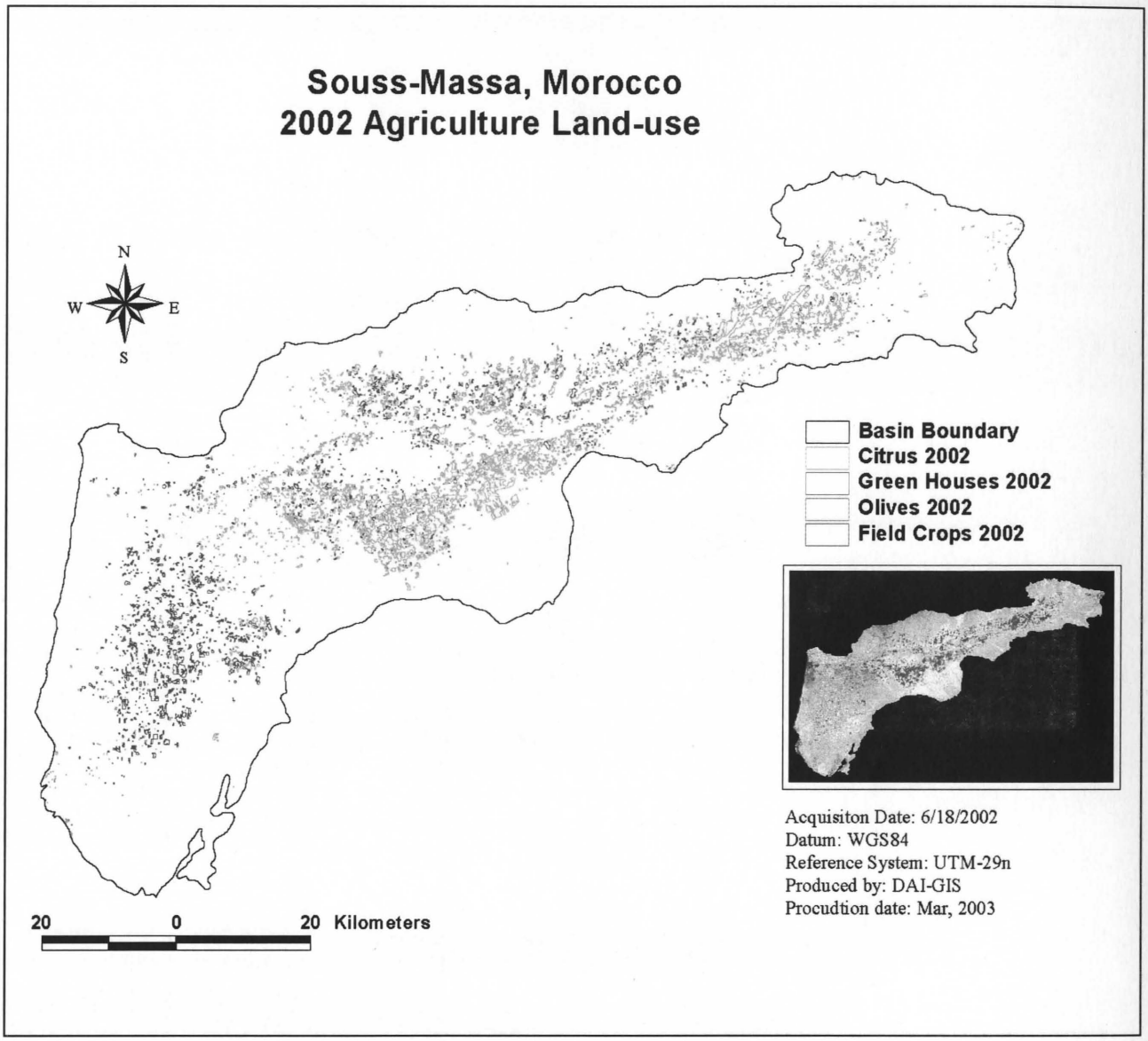

Figure 3. 2002 Cropping (Bouvier and Popescu, 2003)

The same study also focused on an area (Guerdane region) in which the aquifer has been depleted and citrus plantations have been abandoned or are under water stress (over 100 ha–Figure 4). It is clear that continued overdrafting of the aquifer will accelerate the problem. However, the AbH and ORMVA are developing plans to mitigate the problem using a canal to transport surface storage to the area under a plan developed in part with the support of the World Bank. Unfortunately, the impact of this transfer on existing users and resources has not been reported.

Crop Area (ha)	Sum	Count
Citrus - 1984	21,514.43	1,766.00
Citrus - 2002	28,040.92	2,926.00
Greenhouse - 1984	15.30	10.00
Greenhouse - 2002	7,986.58	1,332.00
Olives 1984	595.06	329.00
Olives 2002	321.34	494.00
Field Crops 1984	1,925.69	2,117.00
Field Crops 2002	1,143.55	1,068.00

Table 1. Tabular Statistical Results (area estimates derived from the vector shape files and do not include transitional citrus) (Bouvier and Popescu, 2003)

An allocation model based on water requirements for agriculture and municipal/industrial water was developed, and RBA personnel were provided with software for and training in ModFlow, a finite difference groundwater model currently used world-wide for managing aquifers. The next steps in this activity are to verify the ModFlow models for the Souss and Massa aquifers, expand the allocation model to include economic allocation criteria, and link the groundwater models to the improved allocation model(s). The databases, GIS, and modeling tools have provided, and will continue to provide, the partners with the ability to analyze the impacts—physical and economic—of alternative plans and policies.

Environmental concerns were the principle force behind the implementation of impact assessment. SIWM's involvement with the environment (other than groundwater

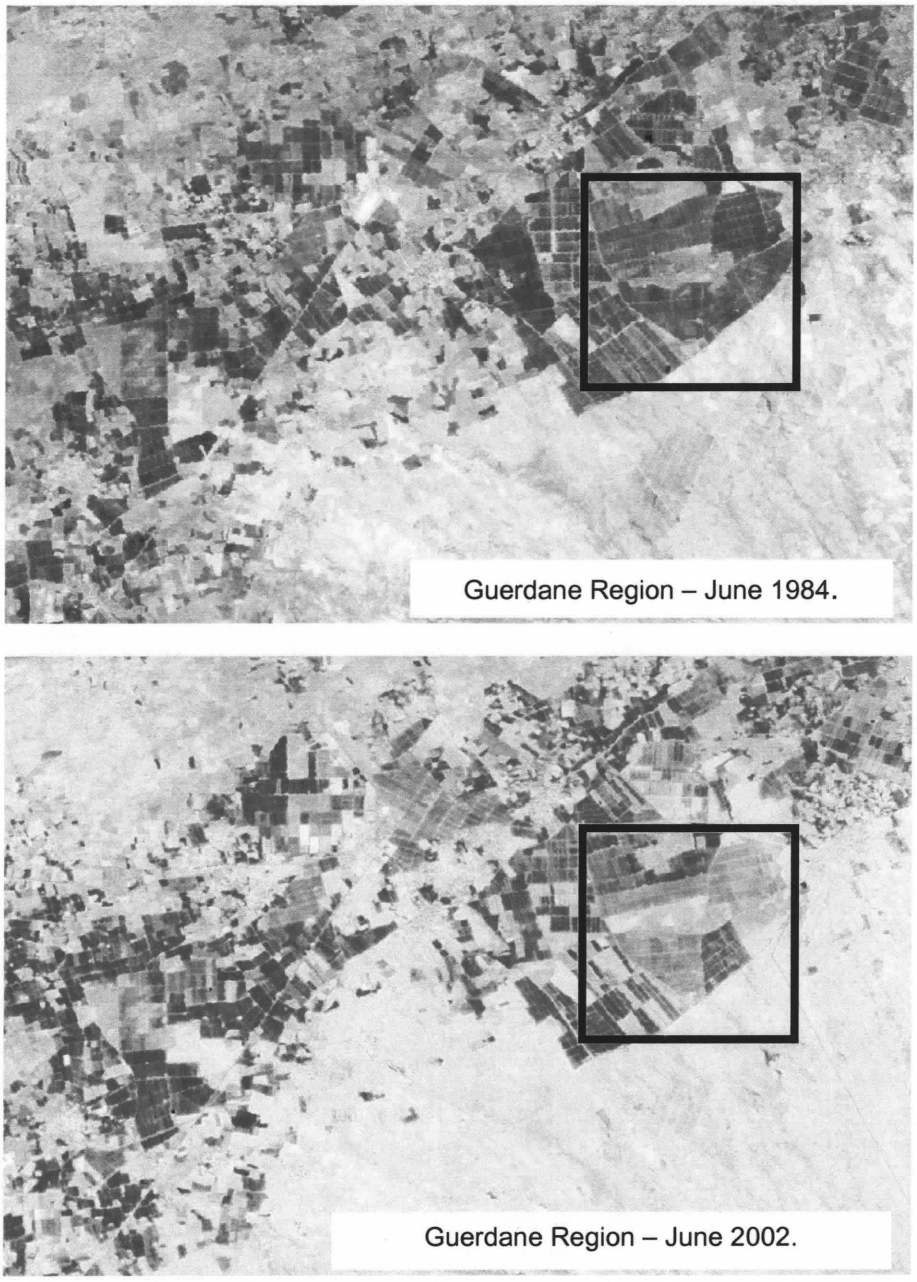

Figure 3. Citrus Production in Guerdane region, south of Taroudant. The black box denotes significant region of change in citrus area (features in deep red indicates citrus area) (Bouvier and Popescu, 2003)

depletion) are two-fold. First, the RBA was given the responsibility for identifying water pollution. One of the SIWM pilot projects has the objective of inventorying point sources of pollution in the Souss-Massa. The results of this inventory will become part of the data bases available to all the partners electronically. This project is just beginning, with the main funding for the survey coming from the Agency budget.

The second activity is related to the coastal zone component of the project. Clearly, pollution of marine waters, especially from untreated urban wastewater and commercial activities along the coast, is a major issue. However, the pollution of fresh water aquifers through salt intrusion is also a critical problem, since many–if not most–of the tourist hotels along the beaches of Agadir use wells as a major source of fresh water. An important institutional constraint to managing water in the coastal zone is the lack of clear authority and responsibility. Once again, there are multiple agencies and groups who impact the coastal zone, and water management must be a coordinated effort. A Coastal Zone Technical Working Group was formed shortly after the new component was added to SIWM's tasks. That group has been involved in identifying several of the key issues facing water managers. SIWM is developing two specific actions in the near term. The first is a study tour by members of technical working group to coastal management sites in the United States. One of the primary objectives of this tour is to observe the governance issues and problems which have developed in the US, and the alternative solutions which have been tried. A second objective is to demonstrate specific technical tools to meet the management challenges, including using treated waste water, desalinization, and various management models (some based in GIS). The third objective is to encourage dialogue among the members of the technical working group, much like the initial integrated water management study tour.

The second action is the organization of a symposium at which technical at governance issues will be discussed, and recommendations made to the Government of Morocco relative to solutions to coastal zone problems in the Souss-Massa. Once again, the technical working group will play a pivotal role in this symposium.

SIWM in Perspective

The SIWM project was undertaken to help reduce the lack of consistent water management in Morocco. Major impediments to integrated management included:

- single-focus agencies working a cross-purpose,
- political barriers to change,
- a divergence of understanding of critical water issues among agencies, users, and the public,
- a seeming disregard for broad approaches to demand management,
- a lack of regional solutions to regional problems,
- limited capacity of small farmers to adapt to water shortages,
- and an apparent absence of communications across water managers at the regional and local levels.

The SIWM project is still a work in progress. However, the project has already demonstrated several issues in integrating planning and management:

- First, adequate data, data sharing and transparency are all essential to real integrated management. Without transparent and available data, assessments of the impacts of policy changes are not likely to be accurate or accepted. Data are crucial to resource management.
- Second, data alone are not sufficient. Tools which use those data must be present so that decision-makers can evaluate effects and results. Moreover, these tools themselves must be accepted widely and results must be understandable.
- Third, communication among decision-makers, both government and private, who deal with the resource or policy must be not only possible, but expected. Approaches which establish lines of communication, mutual interest, and trust must be sought.
- Finally, integrated water management will be successful only when all actors can be involved in assessing the impacts of alternative policies and choosing appropriate solutions.

Literature Cited

Bouvier, R., and I. Popescu. 2003. Souss-Massa Land-Use Mapping Application, SIWM and DAI, Agadir.

Conseil Supérieur de l'Eau et du Climat. 2000. Plan Directeur pour le Developpement des Ressources en Eau des Bassins du Souss-Massa, Session 9. Agadir.

Direction Générale Hydraulique du Maroc. 1999. Ressources en Eau dan les Bassins Souss-Massa et Côtiers Nord d'Agadir: Etat Actuel et Perspective d'Avenir. Handouts at the USAID-DGH Team Debriefing, March 17, Rabat, Morocco.

Kent, R., and S. Ouattar. Undated. Management of Groundwater Resources in the Souss-Massa River Basin, Morocco. SIWM, Agadir, Morocco.

Kent, R., S. Ouattar, J. Higgins, and P. Woodrow. 1999. Supporting the Creation of a Watershed Authority in the Souss-Massa River Basin of Morocco. USAID-FORWARD, Rabat, Morocco.

Ministère de l'Intérieur, Région Souss Massa Drâa, Précture d'Agadir Idao Outanane, Chef Lieu de la Région. Undated. Plan de Développement Economique et Social : 1999/2003 : Région Souss Massa Drâa, Rabat, Morocco.

Ouattar, S., and P. Reiss. 2002. Gestion Intégrée des Ressources en Eau dans le Souss-Massa. USAID-SIWM, Rabat, Morocco.

World Bank. 1995. Kingdom of Morocco Water Sector Review, Report No. 14750-MDR. June.